



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of : **Confirmation No. 4417**  
Masahiro UEKAWA et al. : Atty Docket No. 2001-1018A  
Serial No. 09/918,829 : Group Art Unit 2839  
Filed August 1, 2001 : Examiner Jean F. Duverne

OPTICAL DEVICE PERMITTING PASSIVE  
ALIGNMENT OF LENS ELEMENT

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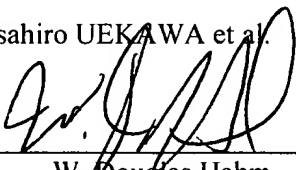
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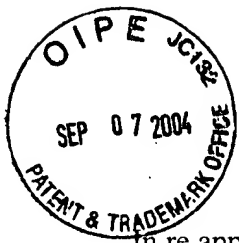
Respectfully submitted,

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE  
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

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**APPELLANT'S BRIEF UNDER 37 CFR 1.192**

Assistant Commissioner for Patents,

Sir:

The following is the Appellant's Brief, submitted in triplicate and in accordance with the provisions of 37 CFR 1.192.

**Real Party in Interest**

The real party in interest is Oki Electric Industry Company, Ltd., of Tokyo, Japan, the assignee of the present invention.

**Related Appeals and Interferences**

There are no known related appeals or interferences.

**Status of Claims**

Claims 1-16 have been cancelled, and claims 17-36 are presently pending. In this regard, claims 17-26, 28, 29, and 31-36 have been rejected, and the rejection of these claims is appealed. A complete copy of the claims on appeal is provided in the Appendix.

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### **Status of Amendments**

No amendments subsequent to the final rejection of January 6, 2004 have been made.

### **Summary of the Invention**

The following is a brief summary of the invention as recited in the appealed claims. Throughout the summary, reference has been made to the drawings and to the substitute specification filed on March 28, 2003. However, reference to these portions of the Application has been made only for the benefit of the Examiner and the Board of Appeals, and is not intended to limit the claims to only the specific embodiments discussed herein.

As explained in paragraph [0004] of the substitute specification, alignment of a CGH (lens) element on an optical substrate with an optical element on a supporting substrate in a conventional optical device requires precise active alignment. In particular, the optical substrate must be continually moved in relation to the supporting substrate while transmitting test light from the optical element, and this process requires a great deal of time as well as expensive test equipment (see lines 3-6 on page 2 of the substitute specification). The present invention as explained below has been developed in order to simplify the alignment process.

As illustrated in Figures 1-4, the optical device of the present invention includes an optical substrate 11 and a lens element 13 formed on the optical substrate 11 (see page 3, lines 9-12 of the substitute specification). A supporting substrate 12 supports an optical element 16, and the supporting substrate 12 has a grooved surface with a groove 18 formed therein (see page 4, line 22 through page 5, line 10 of the substitute specification). The optical substrate 11 has a projecting part 14 (see page 3, lines 12-13 of the substitute specification), and the projecting part 14 rests within the groove 18 formed in the groove surface 12a of the supporting substrate 12 so as to align the lens element 13 with the optical element 16 (see page 5, lines 11-22 of the substitute specification). As a result, simplified and accurate optical alignment of the lens element with the optical element can be achieved without costly and time-consuming active alignment procedures (see page 5, line 23 through page 6, line 8 of the substitute specification).

In order to further enhance the alignment benefits of the present invention, the projecting part 14 and the optical substrate 11 can be formed of silicon and can be integrated to form a one-piece unit (see page 6, lines 9-22 of the substitute specification). Of course, fewer separately-movable components minimizes the possibility of inadvertent misalignment. As illustrated in Figures 1-4 and described on page 3, lines 11-19 of the substitute specification, the lens element can be fixed to the optical substrate. Because the lens element 13 is fixed to the optical substrate 11, the possibility of accidental misalignment within the combination of the lens element 13 and the optical substrate 11 is significantly reduced. As a result, the accuracy of the alignment between the lens element 13 and the optical element 16 supported by the supporting substrate 12 will be significantly improved.

### **Issues**

The issue on appeal is whether claims 17, 19-24, 26, 28, and 32-36 are unpatentable over U.S. Patent No. 5,257,332 to Pimpinella (hereinafter "Pimpinella"); whether claims 18, 25, and 31 are unpatentable over Pimpinella in view of U.S. Patent No. 5,481,629 to Tabuchi (hereinafter "Tabuchi"); whether claim 29 is unpatentable over Pimpinella in view of Tabuchi and further in view of U.S. Patent No. 5,543,255 to Ham (hereinafter "Ham"); and whether claim 32 is unpatentable over Pimpinella in view of Tabuchi and further in view of U.S. Patent No. 5,625,493 to Matsumura et. al. (hereinafter "Matsumura"). More specifically, the above issue can be directed to the following sub-issue: Does any combination of Pimpinella, Tabuchi, Ham, and Matsumura disclose or at least suggest every limitation of claims 17-36?

### **Grouping of Claims**

Dependent claim 31 does not stand or fall with independent claim 17.

Dependent claims 33-36 also do not stand or fall with independent claim 17.

## Argument

### Independent Claim 17 is Patentable Over the Prior Art of Record

Independent claim 17 is directed to an optical device that comprises an optical substrate, a lens element formed on the optical substrate, *an optical element*, and a supporting substrate supporting the optical element. The supporting substrate has a grooved surface with a groove formed therein, and the optical substrate has a projecting part resting within the groove of the supporting substrate so as to align the lens element with the optical element. In the final Office Action of January 6, 2004, the Examiner rejected independent claim 17 under 35 USC § 103(a) as being unpatentable over the Pimpinella reference. In particular, the Examiner asserted that the Pimpinella reference discloses an optical substrate 11, a lens element 20 formed on the optical substrate 11, and a supporting substrate 22 having a grooved surface 26 with a groove 24, 27, or 28 formed therein. The Examiner further noted that the optical substrate 11 has a projecting part 31, 32 resting in the groove 27, 28 formed on the supporting substrate 22 so as to align the lens element 20 with an optical element.

However, the Examiner did not specifically indicate which of the components of the Pimpinella reference corresponds to the *optical element* recited in claim 17. In this regard, because the Examiner asserted that the sphere 20 supported by substrate 11 of the Pimpinella reference corresponds to the lens element of the present invention, and because the lens element must be aligned with the optical element according to claim 17, it would appear that the Examiner is taking the position that the fiber end portion 18 supported by substrate 10 corresponds to the optical element of claim 17. If so, such an interpretation of the Pimpinella reference would not meet the remaining features recited in claim 17. In particular, the coupler 22 (which the Examiner asserts corresponds to the supporting substrate of claim 17) does not support the fiber end portion 18 (which presumably corresponds to the optical element, as explained above). In fact, the coupler 22 does not support *any* of the components of the coupler device, and merely serves as an additional alignment guide that is unnecessary in the present invention due to the arrangement of the components as recited in claim 17.

As illustrated in Figures 1 and 2 of the Pimpinella reference, the first substrate 10 clearly supports fiber end portion 18 of a first optical fiber 15, as well as a lens element 20. Similarly, the second substrate (i.e., optical substrate) 11 clearly supports fiber end portion 18 of a second optical fiber 16, as well as a lens element 20. Thus, it is *possible* that the Examiner could construe the first substrate 10 to correspond to the supporting substrate of independent claim 17, while the second substrate 11 corresponds to the optical substrate 11 of claim 17. However, in that case, neither the first substrate 10 nor the second substrate 11 would have a projecting part resting within a groove formed in a groove surface of the other of the first substrate 10 or the second substrate 11, as required by claim 17. In other words, the Examiner appears to be selectively citing various structural elements of the Pimpinella reference, without proper regard to the *arrangement* of all of the various elements with respect to each other.

In addition, as originally explained to the Examiner in the remarks filed with the Amendment of September 22, 2003, the “projecting parts” (spheres) 31, 32 of the Pimpinella reference rest within *wells* 27, 28 of the coupler 22, rather than within a *groove* (see column 2, line 31 through column 3, line 10 of the Pimpinella reference). On page 5 of the final Office Action of January 6, 2004, however, the Examiner responded to this point by noting that “the groove is clearly shown at 24 and explicitly recited in Pimpinella’s device (see col. 3),” and the Examiner notes that this elongated groove 24 receives fiber 16 (i.e., the optical fiber supported by the second substrate 11). Thus, as the Examiner has noted, the groove 24 formed in coupler 22 receives the optical fibers 15, 16. However, the Examiner has still not explained how the Pimpinella reference discloses or suggests how the groove 24 receives the “projecting parts” 31, 32. Instead, as clearly explained in the Pimpinella reference and noted above, these “projecting parts” (alignment spheres) 31, 32 are received within *wells* 27, 28.

As explained above, it is submitted that the Examiner is construing the Pimpinella reference in a strained manner by inconsistently identifying components of the Pimpinella reference as corresponding to various elements of independent claim 17 in an attempt to meet all of the limitations of claim 17. However, as explained above, a consistent analysis of the Pimpinella reference, including an analysis of the *arrangement* of the components of the

Pimpinella reference with respect to each other, clearly indicates that the Pimpinella reference does not even suggest all of the elements arranged as recited in independent claim 17.

The Examiner asserts that the Tabuchi reference discloses the use of photolithography, that the Ham reference discloses a quartz substrate, and that the Matsumura reference discloses a lens comprising a hologram. However, these references also do not, either alone or in combination, disclose or suggest a supporting substrate supporting an optical element, and an optical substrate having a projecting part resting within a groove formed in a grooved surface of the supporting substrate so as to align a lens element with an optical element, as recited in independent claim 17. Therefore, one of ordinary skill in the art would not be motivated by these references to modify the Pimpinella reference or to combine the references in a manner that would result in the invention recited in independent claim 17. Accordingly, it is respectfully submitted that independent claim 17 is clearly patentable over the prior art of record.

#### Dependent Claim 31 is Patentable Over the Prior Art of Record

In addition to the features of independent claim 17 discussed above, dependent claim 31 further recites that the projecting part and the optical substrate are formed of silicon and are integrated to form a *one-piece unit*. In the final Office Action of January 6, 2004, the Examiner acknowledged that the Pimpinella reference fails to disclose a silicon substrate formed in a one-piece unit. Presumably, the Examiner intended to acknowledge that the Pimpinella reference fails to disclose a projecting part and an optical substrate formed of silicon which are integrated to form a one-piece unit. Nonetheless, the Examiner asserted that the Tabuchi reference discloses an etching process using silicon, and asserts that it would have been obvious to one of ordinary skill in the art to use the etching process of the Tabuchi reference to obtain the optical device of claim 31. However, the Tabuchi reference does not disclose or suggest that a projecting part and an optical substrate are formed in a one-piece unit.

Although the Examiner did not specifically address the limitation regarding the projecting part and the optical substrate being formed as a one-piece unit in the rejection of claim 31, the Examiner did address a similar limitation in the rejection of claims 32-36. In particular, the

Examiner asserted that it would have been obvious to form two components in one piece because it has been held that forming in one piece an article which has formerly been formed in two pieces and put together involves only routine skill in the art. However, the Applicants strongly disagree with this assertion.

Heretofore, optical coupling devices have used numerous *separate* components, such as the spheres 31, 32, and 20, the coupler 22, and the optical substrates 10, 11 of the Pimpinella reference, to couple two optical elements because active alignment techniques have conventionally been used to optically align the optical elements, as explained in paragraph [0004] spanning lines 1-6 on page 2 of the substitute specification. The numerous *separate* components allow the optical substrates to be moved with respect to each other while light is transmitted through the optical elements in order to align the optical elements. In contrast, the present invention as recited in dependent claim 31 proposes forming the projecting part and the optical substrate as *a one-piece unit*, which indicates insight that is contrary to the understandings and expectations of the art. In such a case, the Federal Circuit has found that such a modification can, in fact, be patentable. See *Schenck v. Nortron Corp.*, 713 F.2d 782, 218 USPQ 698 (Fed. Cir. 1983). Consequently, it is submitted that the Examiner's assertion that devices in which two conventionally separate components are formed as a one-piece unit is *prima facie* unpatentable, is improper.

Furthermore, the Pimpinella reference, as noted above, does not contemplate or even suggest forming a projecting part and an optical substrate as a one-piece unit. To the extent that the Examiner is using hindsight to form this rejection, the Applicants assert that this is also improper. See *In re Sang Lee*, 277 F.3d 1338, 61 USPQ.2d 1430 (Fed. Cir. 2002). In the present case, there is absolutely no evidence to support the Examiner's assertion that one of ordinary skill in the art would somehow be motivated by the Tabuchi reference and the Pimpinella reference to form a projecting part and an optical substrate of silicon that is integrated to form a one-piece unit.

Furthermore, the Ham reference and the Matsumura reference also do not disclose or suggest forming a projecting part and an optical substrate of silicon so as to be integrated to form



a one-piece unit, as recited in dependent claim 31. Therefore, one of ordinary skill in the art would not be motivated by these references to modify the Pimpinella reference and the Tabuchi reference in order to obtain the invention recited in claim 31. Accordingly, it is respectfully submitted that, in view of the reasons discussed above with respect to independent claim 17 as well as dependent claim 31, dependent claim 31 is clearly patentable over the prior art of record.

#### Dependent Claims 33-36 are Patentable Over the Prior Art of Record

In addition to the features discussed above with respect to independent claim 17, dependent claim 33 further recites that the lens element is *fixed* to the optical substrate. As explained above with respect to the rejection of dependent claim 31, the Examiner has acknowledged that the Pimpinella reference does not explicitly disclose that a lens element is fixed to an optical substrate. Nonetheless, the Examiner asserted that forming in one piece (i.e., by fixing the lens element to the optical substrate) an article which has formerly been formed in two pieces and put together involves only routine skill in the art. As noted above with respect to dependent claim 31, however, the subject matter recited in dependent claim 33 is contrary to the understandings and expectations of the art, which conventionally teaches separate moveable components to allow for adjustments during active alignment procedures. Thus, in view of *Schenck* as discussed above, it is submitted that fixing the lens element to the optical substrate is not *prima facie* obvious.

Furthermore, as the Examiner has noted in the Office Action, the Pimpinella reference does not even suggest fixing a lens element to an optical substrate. Moreover, the Tabuchi reference, the Ham reference, and the Matsumura reference also do not disclose or suggest fixing a lens element to an optical substrate. Therefore, one of ordinary skill in the art would not be motivated by these references to modify the Pimpinella reference or to combine the references in a manner that would result in the invention recited in dependent claim 33. Accordingly, in view of the reasons discussed above with respect to independent claim 17 as well as dependent claim 33, dependent claim 33 is clearly patentable over the prior art of record.

**Conclusion**

In view of the above, it is respectfully submitted that claims 17-36 are not obvious in view of the Pimpinella reference, the Tabuchi reference, the Ham reference, and the Matsumura reference. Accordingly, the Board is requested to reverse the rejections set forth in the Final Office Action of January 6, 2004.

Respectfully submitted,

Masahiro UEKAWA et al.

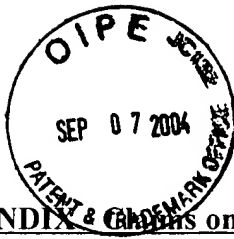
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APPENDIX - Claims on Appeal

Claims 1-16 (Cancelled).

17. An optical device comprising:

an optical substrate;

a lens element formed on said optical substrate;

an optical element; and

a supporting substrate supporting said optical element, said supporting substrate having a grooved surface with a groove formed therein;

wherein said optical substrate has a projecting part resting within said groove formed in said grooved surface of said supporting substrate so as to align said lens element with said optical element.

18. A method of fabricating the optical element of claim 17, comprising:

using photolithography to define said projecting part; and

using photolithography to define said groove formed in said grooved surface of said supporting substrate.

19. The optical device of claim 17, wherein said groove formed in said grooved surface comprises a first groove, said supporting substrate having a second groove formed in said grooved surface, said projecting part of said optical substrate comprising a first projecting part, said optical substrate having a second projecting part resting within said second groove so as to align said lens element and said optical element.

20. The optical device of claim 19, wherein said supporting substrate has a third groove formed in said grooved surface parallel to said first groove and said second groove, said optical element comprising an optical fiber arranged in said third groove.

21. The optical device of claim 17, wherein said supporting substrate has a side adjacent to said optical substrate, said groove formed in said grooved surface extending to said side.

22. The optical device of claim 21, wherein said groove formed in said grooved surface comprises a first groove, said supporting substrate having a second groove formed in said grooved surface parallel to said first groove and extending to said side, said optical element comprising an optical fiber arranged in said second groove.

23. The optical device of claim 21, wherein said groove formed in said grooved surface comprises a first groove, said supporting substrate having a second groove and a third groove formed in said grooved surface, both said second groove and said third groove being formed parallel to said first groove and extending to said side, said projecting part of said optical substrate comprising a first projecting part, said optical substrate having a second projecting part resting within said second groove, and said optical element comprising an optical fiber arranged in said third groove.

24. The optical device of claim 17, wherein said supporting substrate is crystalline, and said groove formed in said grooved surface of said supporting substrate has a V-shaped cross section.

25. A method of forming the optical device of claim 24, comprising forming said grooved surface of said supporting substrate by etching said supporting substrate using an anisotropic etchant.

26. The optical device of claim 17, wherein said supporting substrate comprises:  
a polymer substrate; and  
a grooved resin layer arranged on said polymer substrate so as to form said grooved surface of said supporting substrate.

27. A method of forming the optical device of claim 26, comprising:  
coating said polymer substrate with a photosensitive resin layer;  
selectively exposing said photosensitive resin layer to light through an exposure mask so as to cure exposed portions of said photosensitive resin layer; and  
removing uncured portions of said photosensitive resin layer so as to form said grooved resin layer.

28. The optical device of claim 17, wherein said projecting part extends perpendicularly from a surface of said optical substrate and has a circular cross-section.

29. The optical device of claim 17, wherein said optical substrate comprises a quartz substrate, said projecting part comprising resin material attached to said quartz substrate.

30. A method of forming the optical device of claim 29, comprising:  
coating said quartz substrate with a photosensitive resin layer;  
selectively exposing said photosensitive resin layer to light through an exposure mask so as to cure exposed portions of said photosensitive resin layer corresponding to said projecting part; and  
removing uncured portions of said photosensitive resin layer so as to form said projecting part.

31. The optical device of claim 17, wherein said projecting part and said optical substrate are formed of silicon and are integrated to form a one-piece unit.

32. The optical device of claim 17, wherein said lens element comprises a computer-generated hologram.

33. The optical device of claim 17, wherein said lens element is fixed to said optical substrate.

34. The optical device of claim 33, wherein said optical substrate and said lens element are integrated to form a one-piece unit.

35. The optical device of claim 33, wherein said lens element and said projecting part are fixed to said optical substrate.

36. The optical device of claim 35, wherein said optical substrate, said lens element, and said projecting part are integrated to form a one-piece unit.